DOCUMENT RESUME

ED 302 237 IR 052 568

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TITLE CD-ROM: The Silent Revolution.
PUB DATE 1 Aug 88
NOTE 49p.
PUB TYPE Information Analyses (070) -- Reports - Evaluative/Feasibility (142) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Academic Libraries; Comparative Analysis; Computer Literacy; *Databases; Higher Education; *Information Retrieval; *Information Storage; Intermediate Grades; Learning Resources Centers; Library Role; Literature Reviews; *Optical Data Disks; Questionnaires; School Libraries; Secondary Education; Technological Advancement; Users (Information)
IDENTIFIERS *DIALOG

ABSTRACT

A review of the literature was undertaken to determine whether purchasing DIALOG in the CD-ROM format or subscribing to the DIALOG online format would be the better solution for middle school students interested in information retrieval. This report begins by stating the problem and defining common computer terms. A review of the related literature is then presented which addresses the following subject areas: (1) dreams of tomorrow; (2) CD-ROM (compact disc read-only memory) development; (3) CD-I (compact disc interactive) development; (4) the development of CD-THOR, a compact disc system on which digital data can be stored, retrieved, and erased repeatedly; (5) databases on CD-ROM; (6) replacing the card catalog; (7) DIALOG's online information retrieval services; (8) library services; (9) librarians; (10) school librarians; (11) library of the future; (12) security; (13) benefits; (14) problems; (15) costs; and (16) predictions. On the basis of the literature review, it was concluded that, although CD-ROM is the state-of-the-art in storage and retrieval systems and the system of the future, its cost is currently prohibitive for school districts, and the less frequent updating of the CD-ROM databases makes them less desirable than online systems for use in the middle school. Appendixes include compact-disc player sales statistics; an outline of the storage capacity of CD-ROM for various forms of media; comparisons of the costs of online searching and CD-ROM; and a transmittal letter and questionnaire addressed to computer literacy teachers. (25 references and 44 endnotes) (CGD)

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CD-ROM: THE SILENT REVOLUTION

By

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Submitted in partial fulfillment
of the requirements for the

Course ASC 579
Methods of Educational Research
Dr. David Henderson

August 1, 1988

IR052568

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ABSTRACT

In 1985, the CD-ROM technology was developed from the laser applications. It evolved from the audio compact disc which was an off-shoot of the laserdisc. These scientific inventions are new formats in the optical information storage and retrieval systems.

The CD-ROM is bringing about radical changes to our society. The business community with its huge demand for information, research, and new developments has been the first to use this technology. This exciting revolution of information storage and retrieval systems is truly making an impact upon the educational sector. University libraries are implementing it rapidly. Databases of large information reservoirs such as encyclopedias, card catalogs, Books in Print, and full-text documents are being utilized. The school libraries are on the threshold of this new frontier. With the availability of CD-ROM databases and cost reductions, more public schools will be taking advantage of this system.

Online services will be sharing the market with the CD-ROM products. The two formats will complement each other. CD-ROM is targeted to the more static and historical documentation and the online services provide the current and up-to-date documentations.

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Chapter I

INTRODUCTION

This silent revolution is taking over with a bang! Its impact on libraries is monumental. The storage and space problems that libraries have had for years will be solved. Patrons will do research in minutes instead of hours and the professionals will have resources at their fingertips that were once only dreams. This loud commotion is not saying a word. It is performing on the computer screen. It is called the compact disc - read only memory (CD-ROM).

Statement of the Problem

The CD-ROM technology is obviously the future format of print material. Will libraries convert their vast holdings to this futuristic format? Will the cost of the CD-ROM become competitive with the print format? Will our society be computer literate enough to accept this innovative storage and retrieval system? These and other important questions are needing to be answered in order to prepare our society, our children, and our educational system for the twenty-first century.

Purpose and Significance of the Study

This research endeavor will help the researcher significantly as a Library Consultant for the Aldine

Independent School District. The researcher will need to decide if purchasing DIALOG on the CD-ROM format instead of subscribing to the DIALOG online format is the best solution to researching in the middle schools. Middle school students begin serious researching with the Reader's Guide. In our society today, this method of research is no longer meeting the needs of our students. We are living at a faster pace where more tasks are expected to be accomplished in shorter periods of time. The "old-fashion" method of using the Reader's Guide is slowing becoming archaic.

Definition of Terms

BIT - The smallest piece of data a computer can recognize.

BYTE - An 8-bit unit of digital data.

CD - Compact Disc - The trademark name for an injection-molded aluminized disc, 12 cm in diameter, which stores high-density data in microscopic pits that a laser beam can read.

CD-I - Compact Disc Interactive - A technical specification for a self-contained multimedia system that allows simultaneous, interactive presentation of video, audio, text, and data.

CD-ROM - Compact Disc-Read Only Memory - A version of the Compact Disc standard intended to store general-purpose digital data for personal computers.

DATABASE - A collection of digitally stored information.

DIGITAL - In computing terms, data that is generated as or translated into a series of discrete, fixed values such as digits or other characters.

HARD DISK - An inflexible magnetic disk with greater storage capacity than a floppy disk.

LASER - Light Amplification by Stimulated Emission of Radar - A device that transmits an extremely narrow and coherent beam (separate waves in phase with one another rather than jumbled, as in normal light) of electromagnetic energy in the visible light spectrum.

Mega - Prefix meaning one million.

Megabyte - One million characters.

MEMORY - Synonymous with storage capacity.

ONLINE PROCESSING - A data-processing method that enables a user to enter data, then have it processed and output on request.

OPTICAL DISC - A disc read and/or written by light, generally a laser. Such a disc may store video, audio, or digital data.

VIDEODISC - A generic term describing an optical disc that stores color video pictures and two-channel sound along a spiral track.

Hypotheses

The CD-ROM technology is not revolutionizing the entire industry of computer database retrieval systems. The assumptions that the CD-ROM can retrieve information more quickly, accurately, and inexpensively will be investigated through a literature search.

Scope and Limitations

The scope of this research paper will encompass the background history of the CD-ROM and how it was an undesigned and unplanned offshoot of the laser disc. The limitations will be the inaccessible literature in Sam Houston State University library and the time limit placed upon this project.

Basic Assumptions

The CD-ROM should be economically priced by 1990 so that school districts can consider them for purchase. The price should be comparable to any other computer program and surely be competitive with the print format.

Chapter II

REVIEW OF RELATED LITERATURE

Dreams of Tomorrow

The CD-ROM is a rapidly growing and exploding technology. It is only an infant by research and technological standards. This undesigned and unplanned product of 1985 is an offshoot of the laserdisc that was developed in 1978 and the optical digital audio disc, better known as the compact disc, in 1983.[1] We are living in an exciting period of civilization where the technology is soaring faster than the normal layperson can stay informed. Today's CD-ROM was only yesterday's dream. Dreams of today give us the realities of tomorrow.

As Director of the Office of Scientific Research and Development in 1945, Vannevar Bush was one of those dreamers. Even then, Mr. Bush was concerned about the amount of information that was being accumulated through research. He stated, "Professionally our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose."[2] He was also disturbed because research was being lost because published material was not made available to those who needed to read it.[3] Mr. Bush realized at this point in history that the future would certainly need to be different to

accommodate the vast accumulation of data. This genius of a man predicted the technology of the future that is with us today. One of the most accurately described futuristic dreams of Mr. Bush, in the researcher's opinion, is the CD-ROM. He describes this piece of technology in the following way:

> "Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and, to coin one at random, 'memex' will do. A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."4 "Wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified."5

This dream did come true and we did create the technology to accurately develop the scientific instrument that Mr. Bush profoundly described. As the Book of Proverbs so wisely states, "without a vision, the people perish."6

CD-ROM Development

So what is CD-ROM? The CD stands for compact disc and the ROM stands for read only memory. CD-ROM is an optical information system. Optical information systems are new formats that are replacing some of the media used by libraries. These formats include the audio compact discs, CD-ROM, videodiscs, erasable discs

and write-once discs. They use reflected light from lasers to "read" the variations on the surface of the disc.[7] Tina Roose, director of System Reference Service for the North Suburban Library System, Wheeling, Illinois, exclaimed,

> "Being machine-readable gives us capabilities so far only possible by using online databases. That's revolutionary! Being compact gives us incredible amounts of information in a tiny, tiny space. That's revolutionary!"[8]

In 1961, the laser was developed, leading to optical processing. Lasers allow powerful output because atoms can be stimulated to emit light much faster than they would spontaneously, and they also enable high-speed control to very exacting standards.[9] In 1972, N. V. Philips and MCA companies both demonstrated laser-recorded and laser-read video-disc systems, and in 1974, the two companies announced a common software format. The United States Department of Defense supported the DRAW (Direct Read After Write) disc developed by Philips in 1975. It was expected that this format was to use the technology for programmable optical memories for computers. Laservision technology grew out of laser research. It proved to be too expensive and the video tape format won the Americans' attention and pocketbook. By 1981, videocassette recorders were out-selling all laserdiscs. Laura Buddine, author, consultant, and

president of Tiger Media, Inc. reported, "In 1986, over thirty percent of the United States households owned videocassette recorders, while only about one percent had a videodisc player of any sort."10

Even though laser discs were not successful, its technology led directly to the development of the digital audio compact disc. Many in the electronic industry claim that the CD is the biggest consumer electronic product success to date. Sales statistics for the compact disc players are shown in Appendix A as reported by Predicasts: F. & S. Index, United States Annual Editions, 1985, 1986, and 1987.

Suzanne Ropiequet, author of CD-ROM: Optical Publishing, states,

> "CD-ROM technology is derived from CD audio technology and uses the same basic drive mechanisms and disc manufacturing processes. Because of this close relationship, CD-ROM player and disc development has benefited directly from the technological advances and cost reductions associated with the rapid growth of the CD audio industry."11

The characteristics of the CD-ROM are staggering! The initial application of the compact disc (CD) has been to music. The fidelity of digitally encoded sound far exceeds the traditional long playing record. Compact discs do not scratch or wear out because there is no friction involved in the mechanics. A single 4.72-inch CD-ROM stores 550 megabytes of data, the

equivalent of 1500 floppy disks or twenty-eight 20-magabyte hard disks. That's 250,000 pages, or 500 books, or an entire set of encyclopedias.[12] Appendix B displays the capacity of the CD-ROM technology as reported in the article "CD-ROM: A Revolution in the Making" by Linda Helgerson, editor and publisher of CD Data Report and president of Diversified Data Resources, Inc. Signals on the compact discs are protected by a 1.2 mm thick transparent layer that keeps the plane that the laser beam reads free of dust and damage. The amazing fact about all of this is that any piece of information on the disc can be located and displayed within two or three seconds.[13] The CD-ROM also permits random access, which means the researcher can retrieve information from any place on the disc. Laser discs represent a turning point in information technology. CD-ROM is thought to be a kind of everyman's Memex.[14]

The CD-ROM format already has an industry-wide standard known as the High Sierra Proposal (HSP). In March 1986, at the first international CD-ROM conference in Seattle, Sony and North American Philips announced an agreed-upon standard for compact laser disc products.[15] All CD-ROM discs can be read on any other manufacturer's drives. This is a significant achievement and Suzanne Ropiequet exclaimed, "It

distinguishes CD-ROM from other optical media such as the videodisc and write-once disc, for which no single format has been established."16 The standardization of the CD-ROM products will enable rapid success and growth.

CD-I Development

The Compact disc interactive (CD-I) is the newest product of the laser disc family. The CD-I will enable the compact disc to store a variety of media simultaneously. This includes a mixture of high quality video, audio, and text. As one speaker at the Seattle conference pointed out,

> "With both the CD-ROM and CD-I, we will need to learn to exploit the 'production value' of the medium. Drawing the analogy with the first motion pictures, which simply captured a stage play on film and which the early (theater) critics termed 'dull and uninteresting,' we are still at that stage with CD-ROM products."17

There are already several areas that are targeted for the applications of the CD-I. They are entertainment, education and training, creative leisure, work at home, and in-the-car discs. This CD-I technology will allow a powerful computer system to reach the home. There will be three picture qualities, ranging from normal television studio quality to full screen animation capabilities with the interweaving of pictures and sound. The high resolution modes will be

available on digital televisions in 1988 or 1989. This of course will be limited to slide shows including real-time animation. Four basic levels of sound quality will use Pulse Code Modulation. The four levels range from super high fidelity music mode to speech mode. The High Sierra Group is working on the standards to ensure the compatibility of the CD-ROM with the CD-I.

Latest Development

The major deficiency of the laser digital information storage and retrieval technology has been that once the data is recorded on the disc, the data cannot be altered. The Tandy Corporation has recently announced that it has developed a compact disc system on which data can be stored, retrieved, and erased repeatedly. The company is planning to market this CD-THOR system by 1990 for about five hundred dollars. Tandy claims that the compact disc can be anything digital. This includes digitalized music, computer data, and digitalized video images. The audio digital compact disc can be copied with precise fidelity, and this will probably create further tension between the recording industry and consumer electronics companies. The recording industry fears wholesale piracy of its compact disc recordings.

This new technology will be a boost to the personal computer CD-ROM industry because the CD players will be cheaper and individuals will be able to produce their own databases. Tandy officials predict that the price of blank discs in the near future will be no more than the existing recording tapes.

Four companies, Sony, Panasonic, Hitachi, and Verbatim have already shown prototype erasable optical disc storage systems. Tandy has not disclosed the technology that has produced this erasable disc, but industry experts say that Tandy's technology was based on the ability to write and erase microscopic pits in the dye-polymer. John Markoff, a reporter for the New York Times, explained the technology in the following way:

> "A laser writes information in the dye-polymer media by heating a tiny spot, creating a dimple, or pit. To erase a bit of information, a laser, tuned to a different wavelength and set to a different power, 'smooths out' the dimple. Thus each dimple becomes a one in the digital information code, and when erased becomes a zero."18

Databases

With databases on CD-ROM, random access and free-text capability that was once limited to online databases is now available.[19] With the CD-ROM database the researcher does not need a phone line or pay any hourly connect charge. For a certain dollar amount, an

online database can be purchased and used in the library without needing to connect to a remote computer in another location. A compatible computer with a CD-ROM drive attached is all the necessary equipment needed.

The databases that will be most popular with the CD-ROM format are those that are static, having relatively little change in data content and accommodating infrequent updates. This can be supplemented by magnetic disk technology. The problems of maintaining current databases on CD-ROM will be alleviated by a new laser storage medium. The 3M Corporation has developed the write-once laserdisc hardware. It seems CD-ROM will be enhanced, not replaced.

Public users of the CD-ROM reference systems in the libraries may require frequent changes of the laserdiscs. The industry has already introduced a toaster-size "juke-box" that will hold up to fifty audio compact discs. Similar devices will be used to hold high-use reference databases for frequent retrieval. The juke-box devices will be automatically controlled by the public-users in the library reference collection in conjunction with the microcomputer.

CD-ROM is real and works incredibly well! The CD-ROM will have a tremendous impact on the type and

quantity of the future information resources and the way libraries and users will have access to those resources.

CD-ROM databases have rapidly become at once more user friendly and more sophisticated. The user friendly design is the companies' major priority of the databases. Manufacturers are making the command structure of the databases similar to those of DIALOG, BRS, and SDC. Those users without prior experiences with these on-line searches have an extensive "help" function built into the database. These "help" information sources also teach the user sophisticated search strategies. Future products will have tutorial databases built into each database.

Replacing the card catalog

College libraries are rapidly changing their standard card catalogs to CD-ROM. The user can perform extensive literature searches by author, title, subject, or by bringing together logical categories of information and pinpointing relevant holdings where the categories overlap.[20] Locating materials in a large college library can be overwhelming. Now a user can press a function key and a color map depicting the floor and stack section where the holding is displayed. The user can request a hard copy of the card catalog

data. Director Dr. Patrick Scanlan of the Ritter Library of Baldwin-Wallace College, estimates that a single CD could hold enough data to stock the holdings of three standard-size libraries.21 This provides obvious and considerable room for libraries to add information to existing CDs as their holdings increase. New acquisitions can be added easily to the existing CD. Dr. Scanlan insists that the CD technology is far superior, easier to use, faster, in color, and far less expensive than an on-line system.22 Dr. Scanlan exclaimed,

> "For you online searchers, one tiny CD-ROM can hold 46 entire days' worth of continuous online information transmitted at 1200 baud (c.120 characters per second). As an online searcher, my mind absolutely boggles at this."23

DIALOG

Not too long ago the libraries were devoting their time, money, and space to paper and the printer's ink. Print materials that took whole floors to house are being reduced to a series of invisible electronic impulses and stored on floppy diskettes. With devotion to the printed word, librarians and patrons spent time and energy to search for information using the indexes and abstracts. But, today there is DIALOG! All a library or a patron needs is a computer terminal, modem, phone, and money and they can operate their own

powerful search. Even though some librarians envision the library of the twenty-first century as a desktop modem, the vision is truly a dream at last come true. In the near future it is very possible that even the smallest library will have the necessary resources to have the entire world's knowledge at their patrons' fingertips.

DIALOG is an information retrieval system that is command driven and is operated with layman's language. The online retrieval system uses databases to acquire the needed information. DIALOG is a spin-off of the 1966 National Aeronautics Space Administration (NASA) retrieval system development. The database was the Scientific and Technical Aerospace Reports (STAR) and it contained three hundred thousand items. What originally took NASA twenty-two hours to do in one search, they could do in three minutes with the new information retrieval system. This retrieval system was designed for scientists, but it was soon discovered that librarians were using and needing this tool. Librarians were the ones who got DIALOG into widespread use. The first librarians to use DIALOG were the ones who worked in the government libraries at NASA. In 1972, the Educational Research Information Center (ERIC) was the first education database used with DIALOG. Shortly thereafter, the online information

retrieval service was offered to the public. Anyone with a terminal could subscribe. Lockheed, the parent company, and Dr. Roger Summit, the inventor, built this great database empire. Dr. Summit stated, "We bootstrapped the thing up to the point where we are by far and away the largest computer facility associated with information access in the world."24

DIALOG now offers services to more than fifty thousand password holders. They have access to more than three hundred databases that are available in over eighty countries. The citations are culled from more than sixty thousand journals. Dr. Summit boasted, "Every major university in the country uses DIALOG, and about ninety-seven percent of the libraries that use any online service have DIALOG."25 It is predicted that the number of databases will increase by thirty-five percent every year into the foreseeable future.

DIALOG is in its second phase, DIALOG II. One of DIALOG II's most outstanding features is the expansion of full-text offerings. The greatest demand for the full-text is for news and business-related information.

With the advent of computer-based information services, the library will truly become the information focal point of the community. If the libraries will provide real information service to industry, business,

and to the public, the community will use it more widely and heavily and then the public will be more willing to provide funds to maintain and increase its availability.

Because of this magnificent searching tool, the libraries of tomorrow will become specialists in worldwide and commercial information sources, and will be able to help a patron solve sophisticated search problems. Dr. Summit proclaimed, "Libraries will become a more integral part of their communities, not monuments to obsolete technology."26

Libraries

The technology of the CD-ROM "silverplatters" is symbiotic with libraries. The libraries provide a service to the community and the companies that provide the optical laser discs have a responsibility to support the general needs of the library community. The optical disc companies see several needs of the library community. The business sector is demanding electronic information distribution services. Most libraries that can supply such demands and needs are those who have large budgets. Individuals are demanding rapid access to information, and they, too, will turn away from the traditional libraries if these services are not met.

The solution to these needs is to find a way to attach a fixed-cost to electronic information distribution. The future of libraries will obviously involve the inexpensive microcomputer. Mr. Parke Lightbown, president of International Standard Information Systems, attested, "The CD-ROM optical disc, similarly, will make it possible for information-users to hold vast amounts of machine-readable data at very low-cost."27 Until mass production and use reduce the high price of the CD-ROM system, one suggested remedy to help small libraries that still cannot afford the optical information hardware and databases, is to buy at a reduced price the most affluent subscribing library's discs after they have received the up-dated discs. This arrangement is still being examined by the representatives of the library and the publishing communities.

Once the libraries have the necessary funding, the major problem will be to decide on the "right" technology. Some library administrators still remember the poor investment made by those who chose the Beta video machines instead of the VHS video machines. The difficulty in choosing the "right" technology is directly related to the rapidly changing information technologies.

Librarians

Not only is there a revolution going on in the libraries, but there is a slow evolution taking place. The librarian is the coordinator between the user who needs information and the provider of that information. The librarian is no longer viewed as the keeper of the books, but as the information resource liaison. According to James Kusack, assistant professor at Southern Connecticut State University School of Library Science and Instructional Technology, library students do not put computers at the center of their personal or professional lives.[28] Mr. Kusack pointed out, "They see Librarianship as a conservative and conserving profession and, quite rightfully, see these as attractive characteristics."[29] Change is occurring in the libraries. It should be looked upon as something positive. Today's technology and computers enhance jobs, broaden responsibility, and increase the level of professionalization in Librarianship.[30] Even though libraries are becoming information centers with computer technology at their fingertips, including the introduction of the CD-ROM optical products, librarians must retain their philosophies of service. Most librarians are concerned with content and are not process oriented.[31] Mr. Kusack stated, "Librarians

will continue to be central to our civilization as the principal vehicles for communicating information."32 For information specialists, the challenge is to incorporate the most current technology on the market into their work and provide the best and most efficient service to users.

With the emerging optical digital information technology, the library will soon collect and disseminate these database resources, just as they have traditionally done with the paper-based resources. The future libraries will network and share information through electronic transmission. Many libraries are already involved in regional and national networks that provide access to large databases and online catalogs. Dr. Lawrence Murr, professor at the Oregon Graduate Center, declared,

> "Surveys have indicated that in 1985 libraries in the United States saved ten billion dollars for businesses, especially the scientific enterprises that are heavily dependent upon library research services."33

The department of the United States Bureau of the Census and other organizations that use demographic, statistical, and survey data have been using computers to gather information for some time. CD-ROM gives statistical research power to all librarians, but a new and more detailed method of cataloging must be developed. It will not be enough for librarians to

know where to find demographic data, but rather, they must be able to locate and reproduce the data. To develop a sense for numerical data, additional training and skills must be acquired. Librarians will need to be trained in mathematics, statistics, and the social sciences. They must be prepared to provide answers and not just sources. This trend in the way libraries and librarians will function will lead the way to prestige and higher salaries as the libraries are seen as storehouses of information. Those librarians and educators who are planning for the future do not see this as a new role for librarians, but as an enhanced role that will be visible and needed in all sectors of our society.

School librarians

The development of online and CD-ROM database literature retrieval skills in the kindergarten through twelfth grade group has not kept up with the generalized computer instruction. The students are considered to be computer literate but they cannot engage in literature retrieval skills as another way to utilize the computer. These skills should be taught with the more traditional library instruction.

The librarians are leaving the institutions of higher learning with certifications or master's

degrees in library science and may or may not have any courses, experiences, or training in online or CD-ROM searching. This is one reason why the students from kindergarten through twelth grades are not learning optical disc technology and online searching. Another valid and important reason for this situation is that the school libraries do not have the necessary funding to install the technology in their libraries.

School librarians do not have the opportunities to attend search workshops and updates sponsored by databanks and database producers throughout the school year. If the school librarians do have some skills in electronic searching, they have difficulties staying up with current changes and learning about training courses. Most school librarians do not subscribe to or receive databank or database newsletters to stay current with the changes in the field. There is definitely a desire and a need among school librarians to know more about searching and the new information retrieval technologies. Microcomputers are very common in the school library media centers and have been since the early 1980s, but their use is generally confined to computer assisted instruction. More and more companies are marketing CD-ROM databases that are relevant for the school library media centers. Barbara Wilson, librarian at the Texas Medical Center Library, bragged,

> "Of these, WILSONDISC is one of the most exciting, because this service will include twelve different databases, many of which are less specialty and research oriented than databases marketed by other companies."34

The transfer of search skills from a CD-ROM database to an online literature search is relatively easy. Cypress Fairbanks School District in Houston, Texas, has an excellent program of online searching. The program includes students in both the middle schools and the high schools. The students learn the basics of searching the DIALOG system, how to construct a sound search strategy, and how to select an appropriate database for a particular class project.35

The academic librarians' roles are seen by many to be one that will evolve as consultants to the school librarians. These academic librarians will collaborate to bring CD-ROM and online information search skills to the kindergarten through twelfth grade students. This interaction will enhance the relationship between the two groups of librarians and improve the transition for students as they encounter more complex college and university libraries. This transition would surely provide the students with the basic research skills needed in today's technological society. This new challenge gives the school librarians the opportunity to redefine their roles within the teaching profession.

Library 2000

Our society is preparing for the twenty-first century by evaluating the standards by which we live today. At our schools educators are evaluating the curricula and the libraries. The libraries of today must prepare for the information explosion that has been rivaled by no other time in our civilization.

To accomplish this great task educators and librarians must look at information seekers and users and learn how to improve their productivity and the productivity of information resources. The purposes of this evaluation are varied and numerous. Students, faculty, staff, and clients outside the educational institution must be informed of the data that is available to them. Library personnel will need to increase the users' awareness of information resources through the use of online and optical discs. Knowledge about information and how to obtain it will greatly prepare citizens for tomorrow.

Security

If the security of the CD-ROM computer equipment is a worrisome problem, it can be solved. The computer equipment and the CD-ROM drive can be locked away by several methods. They can be secured with a lockable

cover, a lockable cabinet, or with extra long cables that allow the computer and drive to be locked in a secure location and the screen, keyboard, and printer to be located on a desk for the patrons.

Benefits

With the new development of CD-ROM technology, many will benefit. Publishers will have a new medium with which to work, scientists and research developers will have extraordinary challenges, hardware producers will have an expanded market, and consumers will have low-cost access to a phenomenal wealth of information.36 There are many advantages to having the CD-ROM products. The CD-ROM format eliminates data deterioration and head crashes because the disc is read by a laser beam rather than by a magnetic head in contact with the media. The CD-ROM format cannot be copied at this point in time and that is a big advantage to the manufacturers, and an obvious disadvantage to the owner of the CD-ROM.

Some of the most common CD-ROM products will be the census data, library union catalog, zip codes, and telephone directories.

Problems

There is an old adage that states, nothing is ever as good as it seems and nothing is ever as bad as it seems. As recently as February 1988, it has been reported that there are some problems of incompatibility of the various software programs.[37] Databases that are purchased from different vendors are not compatible with the same hard disc drive.[38] Karla J. Pearce, Assistant Director of Science and Engineering at Columbia University Libraries, asserted,

> "It seems very surprising that vendors would not realize that libraries do not have the space or money to support a single PC and player for each CD-ROM purchased. Yet this is how this software has been programmed."[39]

Instructions are often cryptic and/or misleading. Installation instructions are inadequate. Equipment is delivered incomplete even though certain items were included in the demonstration but not in the purchasing.[40] This is exactly what the industry is trying to prevent with its standards. Each individual database has its own searching strategy. They use descriptors and connectors that are different. This will require the user to learn each system, an extremely time consuming, obviously unnecessary and unacceptable nuisance.

Cost

According to David Anderson, (qtd. in Pearce:38),

> "It is no more expensive to produce a CD-ROM than a printed product. These companies have used the 'perceived value' of the CD-ROM to reap gross profits when, in fact, CD-ROM products should be comparably priced to the paper versions of the same item."41

Karla J. Pearce, reported in February 1988, that the CD-ROM databases have not been economical.[42] She states,

> "Libraries in the science division search extensively on the after-dark systems of BRS, DIALOG, AND CAS online. In 1986-87 they did 1656 searches in the first two systems at an average cost of $4.95 per search. For a CD-ROM that cost $3000, that is the equivalent of 600 online searches."[43]

There is still the controversial issue of cost in this time of an economically depressed society. Ms. Pearce stated, "One is warned not to buy the first generation of any computer product since it may mean acting as an unofficial beta test site."[44] Appendix C depicts a database cost comparison between CD-ROM and online as reported in the article "CD-ROM: A Revolution in the Making" by Lind Helgerson. There is still a great potential with the CD-ROM. The products must fit the customers in regard to user ease, compatibility with other products, equipment, and price.

Predictions

The CD-ROM is ushering in a new phase of information storage and retrieval systems unmatched by any other type of technology known to man. It is estimated by the leading developers of these new electronic products that in twenty-five years, the smallest library in the farthest reaches of America will plug into a world-wide electronic network that will make available all of civilization's recorded knowledge. Future technology will have the capacity to process information at the speed of light using computers the size of a thumbnail and working up to one hundred times faster than today's personal computer. Laserdisc storage the size of a shoe box will be able to store the entire contents of the Library of Congress.

The educational process as we know it today will no longer exist. Users of this sophisticated product will have unlimited resources at their fingertips. The time frame of accessing information will collapse and research and technology will accelerate at a rate that is barely comprehensible to the researcher.

Chapter III

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

CD-ROM technology just a few short years ago was only a dream. Once the laser light was harnessed, products such as laser-recorded and laser-read video disc systems were developed. The laserdisc proved too expensive and it could not compete with the video-tape product. Even though laser discs were not successful, its technology led directly to the development of the digital audio compact disc. The CD is the biggest electronic consumer product success to date. This impact led to the development of the CD-ROM. Using the technology of the CD-ROM and the much needed storage and retrieval capacities, the CD-ROM is revolutionizing the way society is keeping up with the information explosion.

Through research, the evidence is overwhelmingly proving that the CD-ROM is the best product available for storing and retrieving large volumes of information. Cost is the only negative factor to this new format and most experts agree that in the near future the cost will be dramatically reduced, making it affordable for most libraries and laypersons.

Conclusion

The CD-ROM technology may be a silent revolution, but it is certainly making a big commotion! CD-ROM is definitely the state-of-the-art in storage and retrieval systems, and it is certainly the system of the future. The impact of this technology is reaching all sectors of our society.

The business community is leading this revolution in its uses of this format. Companies that are involved in research and development are taking most advantage of these large databases of knowledge.

Universities and colleges are at the forefront with this technology in the educational sector. Unfortunately, in the educational system, the larger universities and colleges are the only ones that presently have the funds available to make this first step toward electronic retrieval systems a reality.

Within five years, the researcher predicts that the CD-ROM databases and players will be a common item in homes and businesses in America.

In the researcher's opinion, all libraries must offer to their patrons the CD-ROM electronic storage and retrieval systems for the most effective research methods. If the library sector falters in this endeavor, businesses will offer this service and take

over this extremely important aspect of library service.

Recommendations

The researcher has researched the literature thoroughly, given the limitations of source availabilities and time. This researcher has embarked upon a study of an exciting and revolutionary technology. The researcher has found that the CD-ROM databases are the future for information storage and retrieval systems. It was also discovered that at this point in time, there are two drawbacks that will prohibit the researcher from implementing the CD-ROM databases in the middle school libraries in the Aldine Independent School District. First of all, the CD-ROM databases are too expensive for the public school budget. Secondly, the updating of the CD-ROM databases are not done frequently enough to compete with the up-to-the-minute source citations and text information.

Based on this limited but rather exhaustive study, the researcher has decided to made the recommendation to implement the DIALOG computer online information retrieval system in the middle schools in the Aldine Independent School District.

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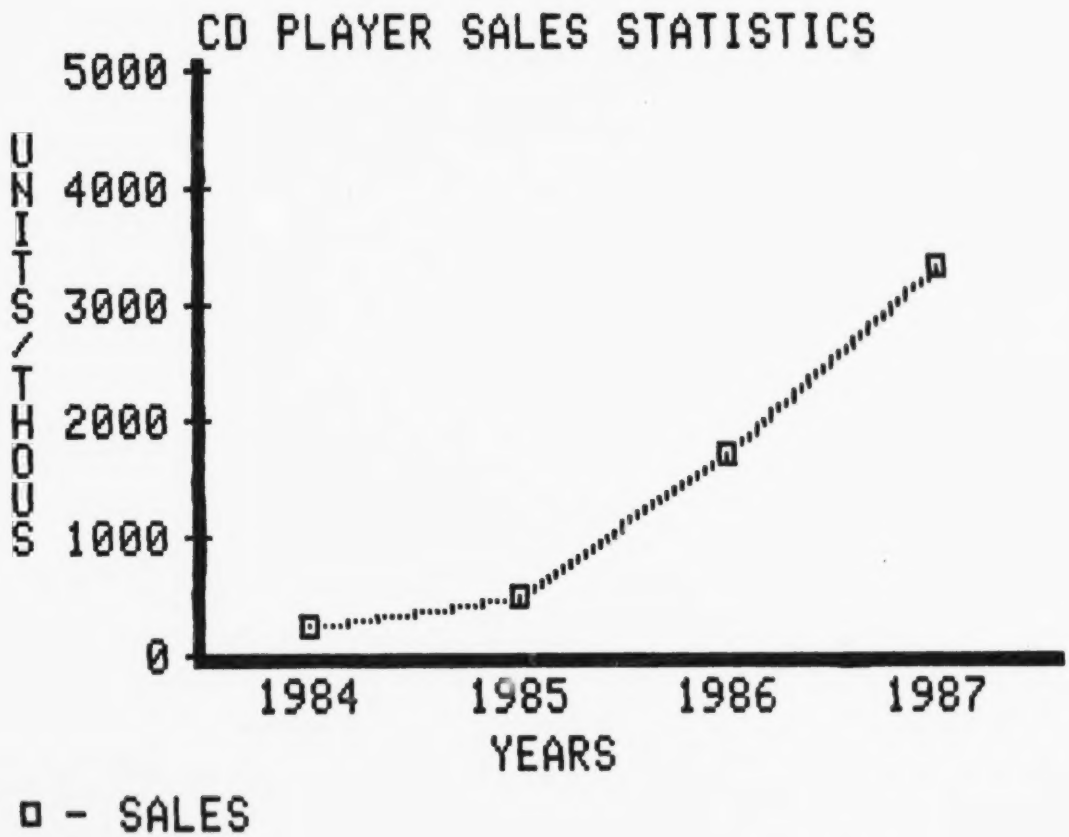
APPENDIX A



NOTE. From Predicasts F. & S. Index, United States Annual Editions, 1985, 1986, and 1987.

APPENDIX B

CAPACITY OF CD-ROM TECHNOLOGY

A CD-ROM disc has approximately eight billion pit locations etched by laser along a three mile long, spiral track storing:

75 minutes of music
-or-

275,000 pages of text
-or-

1,500 floppy disks
-or-

550 million bytes of user data
-or-

18,000 pages of computer graphics
-or-

9,000 pages of graphics and 8-bit stereo audio
-or-

1,800 digitized images (200 dpi, 12:1 compression)
-or-

4,500 hours of digitized voice (16 kbs)
-or-

an entire encyclopedia
with an index to every word
(with plenty of room left to spare!)

NOTE. From "CD-ROM: A Revolution in the Making" by Linda Helgerson, 1986, Library Hi Tech, p25.

APPENDIX C

DATABASE COST COMPARISON
ONLINE VS. CD-ROM

	ONLINE	CD-ROM
Size of Data Base	Virtually Unlimited	Virtually Unlimited
Users Manual/Documentation	$40-$75 hardcopy, plus online	Online, hardcopy optional
Enrollment Fee	$100	None
Connect Charges	$25-$300 per hour	None
Monthly Minimum	$25-$100 per month	None
Learning Costs	$65 for day seminar, $25 for videotape, 4-5 hours online learning time	4 hours, no direct costs
Inquiry Charges	$.08-$55 per item	None
Compact Disc Cost	None	$20-$1000 per CD
Amount of Text	Abstracts	Entire text
Data Transmission Rate	300-1200 baud	1.4 million baud
Response Time	2-10 seconds (once connected)	Less than 2 seconds
Access Time	Virtually immediate	1 second, worst case
Currency of Date	Theoretically current; can be updated daily; normally batch updated	From the time of last CD mastering
Hours of Operation	May be limited: prime time weekdays to 24 hrs., 7 days/week	Unlimited
Equipment Required	Modem, Computer, disk or printer for capture, communications software, telephone	CD-ROM Drive, computer and interface

APPENDIX C
(continued)

NOTE. From "CD-ROM: A Revolution in the Making" by Linda Helgerson, 1986, Library Hi Tech, p24.

APPENDIX D

ALDINE INDEPENDENT SCHOOL DISTRICT

14910 Aldine-Westfield Road • Houston, Texas 77032 • (713) 449-1011

August 1, 1988

Questionnaire applicant:

This questionnaire concerns your knowledge and understanding of the CD-ROM (compact disc-read only memory). Your responses will be confidential and used to evaluate this new library technology as well as for a research study being used for a graduate course at Sam Houston State University.

Please return promptly to Nancy Nassar, Library Consultant, Aldine Independent School District Resource Center. No names are needed on this survey.

Thank you for your cooperation.

Sincerely,

Nancy Nassar,
Library Consultant

APPENDIX E

COMPUTER LITERACY TEACHERS AND CD-ROM

DIRECTIONS: Please circle or answer all items that apply to you. Add comments to make your answers clearer.

1. What is your age?....._____

2. What is your sex?....._____

3. What is your highest degree?.....

   Bachelor's Master's Doctorate

4. What subject do you teach?....._____

5. What grade level to you primarily teach? _____

6. How many professional journals do you read monthly?....._____

7. How many times in a school year do you take your classes to the library?....._____

8. How many times in a school year to you personally visit a school or public library?.... ....._____

9. Do you own a personal computer? Yes No

10. Have you taken a computer-related course in the last three years? Yes No

11. Have you ever taken a course in computer programming? Yes No

12. Do you know anything about the CD-ROM technology? Yes No

    If yes, where did you obtain the information?

    _____

13. List any CD-ROM products owned.

    _____